

## CLAIMS

We claim:

1. A method for automatically controlling the quality of cigarettes produced in a manufacturing process which comprises the steps of:

- a. automatically sampling and testing at least one component part to be used in manufacturing completed cigarettes to measure the value of at least one quality parameter of said at least one component part;
- b. automatically sampling and testing completed cigarettes to measure the value of at least one quality parameter of said completed cigarettes, wherein the quality parameter of said completed cigarettes has a desired relationship to the quality parameter of said component part;
- c. communicating the measured values of the quality parameters measured for said component part and said completed cigarettes to a computer;
- d. evaluating said measured values of the quality parameter measured for said component part and said completed cigarettes by said computer in relation to stored data enabling said computer to:
  - (i) determine, according to a first pre-establish algorithm, whether an adjustment of the operational controls of at least one machine in the manufacturing process is required so that the relationship between the measured value of the quality parameter of said component part and the measured value of the quality parameter of said completed cigarettes will be optimal and if so, to determine, according to said first pre-established algorithm, the degree to

1                   which an adjustment of the operational controls of said at least one machine in  
2                   the manufacturing process should be adjusted, and;

3                   (ii) send an electronic signal by said computer to said at least one machine in the  
4                   manufacturing process to make said adjustment in such degree as was  
5                   determined by said computer;

6                   e. adjusting said one machine in the manufacturing process in accordance with said  
7                   electronic signal sent by said computer.

8                   2. The method of claim 1 wherein said automatic testing and sampling of a component part  
9                   is done at regular intervals during said manufacturing process and wherein said automatic  
10                  testing and sampling of completed cigarettes is done at regular intervals during said  
11                  manufacturing process.

12                 3. The method of claim 1 wherein said automatic testing and sampling of a component part  
13                 is done at intervals of less than five minutes during said manufacturing process and  
14                 wherein said automatic testing and sampling of completed cigarettes is done at intervals  
15                 of less than five minutes during said manufacturing process.

16                 4. The method of claim 3 wherein said completed cigarettes automatically tested and  
17                 sampled are completed cigarettes which are manufactured from the component parts  
18                 drawn from the same sub-population as the sub-population of component parts which  
19                 have been automatically tested and sampled.

20                 5. The method of claim 1 wherein the step of automatically sampling and testing at least one  
21                 component part includes automatically sampling and testing filter sections.

22                 6. The method of claim 5 wherein the step of automatically sampling and testing completed  
23                 cigarettes to measure the value of at least one quality parameter includes measuring the

1 circumference of the tobacco component of said completed cigarettes, and wherein the  
2 step of automatically sampling and testing filter sections includes measuring the  
3 circumference of said filter sections.

4 7. The method of claim 5 wherein the step of automatically sampling and testing filter  
5 sections further includes measuring the pressure drop across said filter sections and where  
6 the step of automatically sampling and testing completed cigarettes further includes  
7 measuring the ventilation of said completed cigarettes.

8 8. The method of claim 5 wherein the step of automatically sampling and testing at least one  
9 component part further includes automatically sampling and testing tobacco rod  
10 segments.

11 9. The method of claim 8 wherein the step of automatically sampling and testing completed  
12 at least one quality parameter of at least one component part includes measuring the  
13 density of tobacco rod segments.

14 10. The method of claim 9 wherein the step of automatically sampling and testing filter  
15 sections further includes measuring the weight of said filter sections and wherein the step  
16 of automatically sampling and testing completed cigarettes further includes measuring the  
17 weight of said completed cigarettes.

18 11. The method of claim 8 wherein the step of automatically sampling and testing at least one  
19 quality component of at least one component part includes measuring the weight of  
20 tobacco rod segments.

21 12. The method of claim 11 wherein the step of automatically sampling and testing filter  
22 sections further includes measuring the weight of said filter sections and wherein the step

1 of automatically sampling and testing completed cigarettes further includes measuring the  
2 weight of said completed cigarettes.

3 13. The method of claim 1 further comprising the steps of

4 a. measuring during the production process by an in-line measuring device, the  
5 value of at least one quality parameter of at least one component part which  
6 quality parameter of said component part has a known relationship to at least one  
7 quality parameter measured by said automatic testing and sampling of said  
8 completed cigarettes;

9 b. communicating said measured value of at least one quality parameter of said  
10 component part measured by said in-line measuring device to said computer;

11 c. evaluating said measured value of said quality parameter of said component part  
12 by said in-line measuring device in relation to the values of a least one quality  
13 parameter measured by said automatic testing and sampling of said completed  
14 cigarettes by said computer to determine whether said measured value of at least  
15 one quality parameter of said component part measured by said in-line measuring  
16 device is accurate and if not, enabling said computer to:

17 (i) determine, according to a second pre-establish algorithm,  
18 whether a recalibration of said in-line measuring device is  
19 required and if so, to determine, according to said second pre-  
20 established algorithm, the degree to which such recalibration is  
21 required, and;

22 (ii) send an electronic signal by said computer to said at least one  
23 machine in the manufacturing process to recalibrate such in-line

measuring device in such degree as was determined by said  
computer;

d. recalibrating said in-line measuring device in accordance with said electronic  
signal from said computer.

14. The method of claim 13 wherein said component parts include tobacco rod segments and  
filter sections.

15. The method of claim 14 wherein the quality parameter measured by said in-line  
measuring device includes the density of said tobacco rod segments and wherein the  
quality parameters of completed cigarettes measured by said automatic testing and  
sampling of said completed cigarettes includes the weight of said completed cigarettes  
and wherein the quality parameters of filter sections measured by said automatic testing  
and sampling of said filter sections includes the weight of said filter sections.

16. The method of claim 14 wherein the quality parameter measured by said in-line  
measuring device includes the weight of said tobacco rod segments and wherein the  
quality parameters of completed cigarettes measured by said automatic testing and  
sampling of said completed cigarettes includes the weight of said completed cigarettes  
and wherein the quality parameters of filter sections measured by said automatic testing  
and sampling of said filter sections includes the weight of said filter sections.

17. The method of claim 14 wherein the quality parameter of a said component part  
measured by said in-line measuring device includes the circumference of said tobacco rod  
segments and wherein the quality parameters of completed cigarettes measured by said  
automatic testing and sampling of said completed cigarettes includes the circumference  
of the tobacco component of said completed cigarettes.

1 18. A method for automatically controlling the quality of cigarettes produced in a  
2 manufacturing process which comprises the steps of:

3 f. automatically sampling and testing at least one component part to be used in  
4 manufacturing completed cigarettes to measure the value of at least one quality  
5 parameter of said at least one component part;

6 g. automatically sampling and testing completed cigarettes to measure the value of at  
7 least one quality parameter of said completed cigarettes, wherein the quality  
8 parameter of said completed cigarettes has a desired relationship to the quality  
9 parameter of said component part;

10 h. communicating the measured values of the quality parameters measured for said  
11 component part and said completed cigarettes to a computer;

12 i. evaluating said measured values of the quality parameter measured for said  
13 component part and said completed cigarettes by said computer in relation to stored  
14 data enabling said computer to:

15 (i) determine, according to a first pre-establish algorithm, whether an adjustment  
16 of the operational controls of at least one machine in the manufacturing  
17 process is required so that the relationship between the measured value of the  
18 quality parameter of said component part and the measured value of the  
19 quality parameter of said completed cigarettes will be optimal and if so, to  
20 determine, according to said first pre-established algorithm, the degree to  
21 which an adjustment of the operational controls of said at least one machine in  
22 the manufacturing process should be adjusted;

1 (ii) generate a set of video displays to indicate the adjustment which should be  
2 made in the operational controls of said at least one machine in the  
3 manufacturing process, and;

4 (iii) communicate said set of video displays to a video display terminal;  
5 j. displaying on a video display terminal said set of video displays indicating the  
6 adjustment which should be made in the operational controls of said at least one  
7 machine in the manufacturing process.

8 19. The method of claim 18 wherein said automatic testing and sampling of a component part  
9 is done at regular intervals during said manufacturing process and wherein said automatic  
10 testing and sampling of completed cigarettes is done at regular intervals during said  
11 manufacturing process.

12 20. The method of claim 18 wherein said automatic testing and sampling of a component part  
13 is done at intervals of less than five minutes during said manufacturing process and  
14 wherein said automatic testing and sampling of completed cigarettes is done at intervals  
15 of less than five minutes during said manufacturing process.

16 21. The method of claim 20 wherein said completed cigarettes automatically tested and  
17 sampled are completed cigarettes which are manufactured from the component parts  
18 drawn from the same sub-population as the sub-population of component parts which  
19 have been automatically tested and sampled.

20 22. The method of claim 18 wherein the step of automatically sampling and testing at least  
21 one component part includes automatically sampling and testing filter sections.

22 23. The method of claim 22 wherein the step of automatically sampling and testing  
23 completed cigarettes to measure the value of at least one quality parameter includes

1 measuring the circumference of the tobacco component of said completed cigarettes, and  
2 wherein the step of automatically sampling and testing filter sections includes measuring  
3 the circumference of said filter sections.

4 24. The method of claim 22 wherein the step of automatically sampling and testing filter  
5 sections further includes measuring the pressure drop across said filter sections and where  
6 the step of automatically sampling and testing completed cigarettes further includes  
7 measuring the ventilation of said completed cigarettes.

8 25. The method of claim 22 wherein the step of automatically sampling and testing at least  
9 one component part further includes automatically sampling and testing tobacco rod  
10 segments.

11 26. The method of claim 25 wherein the step of automatically sampling and testing at least  
12 one quality component of at least one component part includes measuring the density of  
13 tobacco rod segments.

14 27. The method of claim 26 wherein the step of automatically sampling and testing filter  
15 sections further includes measuring the weight of said filter sections and wherein the step  
16 of automatically sampling and testing completed cigarettes further includes measuring the  
17 weight of said completed cigarettes.

18 28. The method of claim 25 wherein the step of automatically sampling and testing at least  
19 one quality parameter of at least one component part includes measuring the weight of  
20 tobacco rod segments.

21 29. The method of claim 28 wherein the step of automatically sampling and testing filter  
22 sections further includes measuring the weight of said filter sections and wherein the step



1 of automatically sampling and testing completed cigarettes further includes measuring the  
2 weight of said completed cigarettes.

3 30. The method of claim 27 further comprising the steps of

4 a. measuring during the production process by an in-line measuring device, the  
5 value of at least one quality parameter of at least one component part which  
6 quality parameter of said component part has a known relationship to at least one  
7 quality parameter measured by said automatic testing and sampling of said  
8 completed cigarettes;

9 b. communicating said measured value of at least one quality parameter of said  
10 component part measured by said in-line measuring device to said computer;

11 c. evaluating said measured value of at said quality parameter of said component  
12 part by said in-line measuring device in relation to the values of a least one  
13 quality parameter measured by said automatic testing and sampling of said  
14 completed cigarettes by said computer to determine whether said measured value  
15 of at least one quality parameter of said component part measured by said in-line  
16 measuring device is accurate and if not, enabling said computer to:

17 (i) determine, according to a second pre-establish algorithm,  
18 whether a recalibration of said in-line measuring device is  
19 required and if so, to determine, according to said second pre-  
20 established algorithm, the degree to which such recalibration is  
21 required, and;

22 (ii) send an electronic signal by said computer to said at least one  
23 machine in the manufacturing process to recalibrate such in-line

1 measuring device in such degree as was determined by said

2 computer;

3 d. recalibrating said in-line measuring device in accordance with said electronic

4 signal from said computer.

5 31. The method of claim 30 wherein said component parts include tobacco rod segments and  
6 filter sections.

7 32. The method of claim 31 wherein the quality parameter measured by said in-line  
8 measuring device includes the density of said tobacco rod segments and wherein the  
9 quality parameters of completed cigarettes measured by said automatic testing and  
10 sampling of said completed cigarettes includes the weight of said completed cigarettes  
11 and wherein the quality parameters of filter sections measured by said automatic testing  
12 and sampling of said filter sections includes the weight of said filter sections.

13 33. The method of claim 31 wherein the quality parameter measured by said in-line  
14 measuring device includes the weight of said tobacco rod segments and wherein the  
15 quality parameters of completed cigarettes measured by said automatic testing and  
16 sampling of said completed cigarettes includes the weight of said completed cigarettes  
17 and wherein the quality parameters of filter sections measured by said automatic testing  
18 and sampling of said filter sections includes the weight of said filter sections.

19 34. The method of claim 31 wherein the quality parameter of a said component part  
20 measured by said in-line measuring device includes the circumference of said tobacco rod  
21 segments and wherein the quality parameters of completed cigarettes measured by said  
22 automatic testing and sampling of said completed cigarettes includes the circumference  
23 of the tobacco component of said completed cigarettes.